REMARKS

Claims 1-13, 17, and 19 are now present in this case. Consideration of the application in view of the canceled and amended claims, modified figures, and the following remarks is respectfully requested.

Applicants thank the Examiner for allowing claims 1 – 13.

Claims 17 and 19 are objected to by the Examiner as being dependent on a rejected base claim. Applicants have taken the advice of the Examiner and have rewritten claims 17 and 19 in independent form including all of the limitations of the base claim and any intervening claims.

Paragraph 35 (pages 16 – 17) of the specification has been amended to properly refer to element 325, instead of element 315, in figure 3C. The reference to element 315 was an inadvertent typographical error. No new matter has been added by making this change.

Figure 1 has been modified to eliminate reference to unused element number 190. Figure 4A has been modified to eliminate the reference to unused element numbers 420, 430, and 440. Figure 4B has been modified to eliminate reference to unused element numbers 460, 465, and 470. There is no element 485 in figure 4B as referred to in the Office Action. No new matter has been added by the elimination of these unused element numbers. Substitute drawings are enclosed herewith (please see Appendix) that reflect the stated changes.

Based on the foregoing remarks, Applicants believe that the objections in the Office Action of June 27, 2002 are fully overcome, and that the application is in condition for allowance. If the Examiner has questions regarding the case, he is invited to contact Applicants' undersigned representative at the number given below.

Respectfully submitted,

Tony P. Chiang et al.

Date: Sept. 24, 2002

By:

Bradley W. Scheer, Reg. No. 47,059
Carr & Ferrell, *LLP*
2225 East Bayshore Road, Suite 200
Palo Alto, CA 94303
TEL: (650) 812-3400
FAX: (650) 812-3444

APPENDIX

To Show Changes in the Claims

17. A sequential method for integrated, in-situ modification of a substrate and subsequent atomic layer deposition of a thin film onto said substrate in an evacuated chamber beginning with initial modification steps, comprising:

introducing at least one first radical generating feed gas into said chamber;

[The sequential method of claim 14 wherein said atomic layer deposition steps additionally include]

introducing at least one ion generating feed gas into said chamber; [and]

generating a plasma from said radical generating feed gas to form radicals and from said ion generating feed gas to form ions;

[generating a plasma from said ion generating feed gas to form ions.];

exposing said substrate to said radicals;

reacting said substrate with said radicals to remove any contaminants from said substrate and producing a modified substrate; and

following said initial modification steps, performing an atomic layer deposition of a thin film onto said modified substrate in said chamber including:

introducing a first reactant gas into said chamber;

adsorbing at least one monolayer of said first reactant gas onto said modified substrate;

evacuating any excess said first reactant gas from said chamber;

introducing at least one additional radical generating feed gas into said chamber, said additional radical generating feed gas is ~~may be~~ the same feed gas as said first radical generating feed gas;

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generating a second plasma from said additional radical generating feed gas to form additional radicals;

exposing said modified substrate to said additional radicals; and

reacting said adsorbed monolayer of said first reactant gas with said additional radicals to deposit said thin film.

19. A sequential method for integrated, in-situ modification of a substrate and subsequent atomic layer deposition of a thin film onto said substrate in an evacuated chamber beginning with initial modification steps, comprising:

introducing at least one first radical generating feed gas into said chamber;

generating a plasma from said radical generating feed gas to form radicals;

exposing said substrate to said radicals;

reacting said substrate with said radicals to remove any contaminants from said substrate and producing a modified substrate; and

following said initial modification steps, performing an atomic layer deposition of a thin film onto said modified substrate in said chamber including:

introducing a first reactant gas into said chamber;

adsorbing at least one monolayer of said first reactant gas onto said modified substrate;

evacuating any excess said first reactant gas from said chamber;

introducing at least one additional radical generating feed gas into said chamber, said additional radical generating feed gas ~~may be~~ is the same feed gas as said first radical generating feed gas;

generating a second plasma from said additional radical generating feed gas to form additional radicals;

exposing said modified substrate to said additional radicals;

reacting said adsorbed monolayer of said first reactant gas with said additional radicals to deposit said thin film; and

[The sequential method of claim 14 wherein said method is repeated for] repeating each of the aforementioned steps for each film deposition layer.

To Show Changes in the Specification

[0035] FIG. 3A illustrates a high aspect ratio via containing an oxidized **300** copper underlayer **305** prior to preclean. FIG. 3B shows a high aspect ratio via showing sidewall redeposition **320** of the sputtered copper oxide **300** removed from the bottom of the via and tapering of the via corners **315** due to excessive argon ion **177** sputtering (illustrating the issues associated with problems in the prior art). FIG. 3C shows a high aspect ratio via showing the present invention whereby the copper oxide **300** has been removed without sidewall redeposition **320** and without adverse tapering of the via corners [**315**]<u>**325**</u>. This same process can also remove carbonaceous impurities left behind during the etching of the vias (either along the sides or bottoms of the vias). Subsequent deposition of a barrier layer (e.g., Ta, TaN_x, etc.) via the introduction of a suitable tantalum containing precursor (e.g., $TaCl_5$, $TaBr_5$, etc.) can be performed via MII-ALD. The same atomic hydrogen **176** is now used as the reducing agent to form metallic Ta and byproducts (e.g., HCl or HBr), which can be readily pumped **184** away.

Three (3) Pages of Substitute Drawings Begin on Next Page